Disposable cortisol biosensor developed

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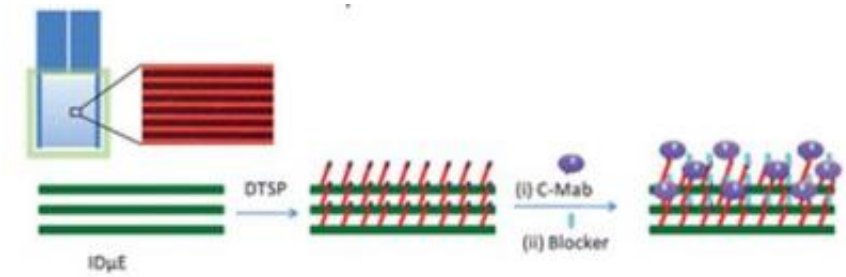

Image credit: Analyst, 2010, doi:10.1039/c0an00242a

(PhysOrg.com) -- Scientists in the US have developed a disposable, non-invasive new biosensor to monitor levels of the stress hormone, cortisol, and say the ultrasensitive electrochemical impedance technique it uses could transform the diagnosis of stress disorders.

Cortisol is a hormone that helps maintain blood pressure, glucose levels, and carbohydrate metabolism within normal physiological limits. Abnormal levels of the hormone cortisol have been linked to stress-related disorders such as post-traumatic stress disorder, irritable bowel syndrome and chronic fatigue syndrome.

The new sensor tests untreated saliva for cortisol levels, and produces results within 40 minutes. It could replace tests such as radioimmunoassays, enzyme-linked immunosorbent assays or liquid chromatography, all of which are lengthy and require the samples to be sent to a laboratory, and which often require pre-treatment of the saliva

and the use of radioisotope labeling. The new biosensor gives comparable results to the laboratory assays but results can be obtained at the point of patient care. Cortisol levels in saliva correlate well with blood levels of the hormone.

The biosensor was developed by a team led by Sunil Arya of the University of South Florida in Tampa, and measures cortisol down to levels as low as 1pM. It uses a technique called electrochemical impedance spectroscopy (EIS) with a series of parallel bands of electrodes with alternate bands connected together.

The technique offers rapid reaction kinetics and improved sensitivity and increased signal-to-noise ratio, according to Arya, and the method records the information directly at the electrode surfaces without the need for radioisotope labeling.

The device is calibrated by being incubated with a range of standards for cortisol. Cortisol is a natural insulator and binds to the electrode surface, insulating and increasing the resistance. Then a solution of ferrocyanide (Fe^{2+}) and ferricyanide (Fe^{3+}) is used as a redox probe to measure the resistance to charge transfer from the solution to the electrode, which is proportional to the amount of cortisol in the solution.

The new method has been validated with human saliva samples, but it is not yet commercially available. Arya and the team are now exploring commercialization options, and envision it becoming available in a system rather like glucose sensors. The cost of production of the sensors would be low enough to allow them to be disposable for use at point of care.

More information: Antibody functionalized interdigitated u-electrode (IDuE) based impedimetric cortisol biosensor, Sunil K. Arya, Analyst, 2010, DOI: 10.1039/c0an00242a